

April 27

Goals:

- be able to distinguish between growth and decay
- be able to put exponential functions into context of life outside school

Exponential Growth

- Graphs that increase exponentially
 - > Accelerating your car
 - > Compound interest
 - > Doubling, tripling, quadrupling
 - > % increases

General Equation

$$y = A(b)^x$$

Examples

- Where y is the total amount.
- A is the original amount or initial amount.
- b is called the growth factor.
- In exponential growth $b > 1$
- x is the amount of time.

$$Y = 3(2^x)$$

Example - Exponential Growth

- A strain of yeast cells triples every hour.
- Suppose there are 60 cells now. $A = 60$
- a) Write an equation to represent the total number of yeast cells in "t" hours from now.

$$Y = 60(3)^t \quad b = 1 + 2 \text{ (grown by } 200\%) = 3$$

- b) How many cells are there 5 hours from now.

$$Y = 60(3)^5 \\ = 60(243)$$

$$= 14580$$

Example 2 - Growth

- A school has an enrolment of 1200 students.
- The student population is expected to grow at a rate of 1.5% each year for the next 10 years.
- a) What is the growth factor as a decimal?

$$b = 1 + 0.015 = 1.015$$

- b) Write an equation to represent the total number of students enrolled "n" years from now.

$$Y = Ab^x \\ Y = 1200(1.015)^n$$

- c) Calculate the number of students enrolled 8 years from now.

$$Y = 1200(1.015)^8 \\ = 1351.7 \\ \approx 1352$$

Exponential Decay

- Graphs that decrease exponentially
 - > Slamming on the brakes
 - > Car depreciation
 - > Half-life
 - > % decreases

General Equation

$$y = A(b)^x$$

- Where y is the total amount.
- A is the original amount or initial amount.
- b is called the decay factor.
- In exponential decay
 $0 < b < 1$
 (ie. fraction or decimal)
- x is the amount of time.

Examples

$$y = 2000(0.2)^x$$

$$y = 1000(0.1)^x$$

Example - Decay

- A radioactive substance has a half-life of 5 days. Suppose you have 70 g. of this substance now.
- a) Write an equation to represent the mass of the substance, y (in grams), after " x " half-lives.
- b) Calculate the mass of the substance 30 days from now?

$$y = 70(0.5)^{x/5}$$

$$\begin{aligned}
 y &= 70(0.5)^{30/5} \\
 &= 70(0.5)^6 \\
 &= 1.09\text{g}
 \end{aligned}$$

$$\begin{aligned}
 &70 \\
 &35 \\
 &17.5 \\
 &8.75 \\
 &4.375 \\
 &2.18 \\
 &1.09
 \end{aligned}$$

Example 2 - Decay

- A photocopier sells for \$12000. Each year it depreciates, or decreases in value, by 15%.
- a) Determine the decay factor, " b ".
- b) Write an equation to represent the value, y (in dollars), of the photocopier when it is " n " years old.

$$1 - 0.15 = 0.85$$

$$y = 12000(0.85)^n$$

- c) Find the value of the machine when it is 5 years old.

$$y = 12000(0.85)^5$$

$$= \$5324.46$$